

## SEAT BELT DEVICE

## CROSS REFERENCES TO RELATED APPLICATIONS

[0001] The present application claims priority under 35 U.S.C. §119 to Japanese Patent Application No. 2014-150973, filed Jul. 24, 2014, entitled "Seat Belt Device." The contents of this application are incorporated herein by reference in their entirety.

## BACKGROUND

[0002] 1. Field

[0003] The present disclosure relates to a seat belt device.

[0004] 2. Description of the Related Art

[0005] For instance, Japanese Unexamined Patent Application Publication (JP-A) No. 2014-34221 discloses a technology for a motor control device and a seat belt device, the motor control device being capable of avoiding an increase of dark current without adding a component such as a relay even when a failure occurs in a switching element included in a motor drive circuit, the seat belt device utilizing the motor control device for winding drive control of a belt reel.

[0006] According to the technology disclosed in JP-A No. 2014-34221, when a failure occurs in a switching element, the winding drive of the belt reel is stopped. For this reason, there is a problem in that a proper restraining force may not be applied to an occupant in the case of a high emergency level such as an occurrence of a collision.

## SUMMARY

[0007] The present disclosure has been made to solve the above-mentioned problem and provides a seat belt device that is capable of applying a restraining force to an occupant properly regardless of the type of error even in the case of a high emergency level.

[0008] A first aspect of the present disclosure provides a seat belt device including: a belt reel that winds a webbing; an electric motor that drives the belt reel to wind; a collision predictor that predicts a collision with an object to generate a pre-collision signal; and a controller that is connected to the collision predictor via a network and that starts and performs winding control of the electric motor when a collision with the object is predicted by the collision predictor. After the controller receives information on collision prediction including the pre-collision signal from the collision predictor via the network, even when a communication failure occurs between the controller and the collision predictor, the controller performs control to cause the electric motor to continue winding control.

[0009] A second aspect of the present disclosure provides the seat belt device according to the first aspect that further includes an anomaly detector that detects an occurrence of anomaly in a signal line that connects between the controller and the electric motor. After the controller receives information on collision prediction from the collision predictor via the network, in the case where an anomaly is detected by the anomaly detector, the controller performs control to stop winding drive of the belt reel.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a front view illustrating a wearing state of a seat belt device according to an embodiment of the present disclosure.

[0011] FIG. 2 is a block diagram illustrating the configuration of a control system of the seat belt device according to the embodiment of the present disclosure.

[0012] FIG. 3 is a flow chart illustrating the processing operation when an error occurs in the seat belt device according to the embodiment of the present disclosure.

[0013] FIGS. 4A and 4B illustrate operation conceptual diagrams when an error occurs in the seat belt device according to the embodiment of the present disclosure.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Hereinafter, a seat belt device **10** according to an embodiment of the present disclosure (hereinafter, simply referred to as the present embodiment) will be described in detail with reference to the accompanying drawings.

## Configuration of Embodiment

[0015] The configuration of the seat belt device **10** according to the present embodiment will be described with reference to FIG. 1. FIG. 1 illustrates an exemplary configuration that includes the seat belt device **10** so that an occupant seated on a seat **19** provided in a vehicle is properly restrained. Although only the driver seat side is illustrated here, the passenger seat side of the vehicle is also provided with the seat belt device **10**. The seat belt device **10** is capable of winding a webbing **16** by a retractor **14** which is provided in a side portion of the vehicle body, the webbing **16** being designed to restrain a shoulder and the waist of the occupant at the same time.

[0016] The seat belt device **10** performs winding control of the webbing **16** by the later-described pretensioner unit **50R** (FIG. 2) that controls the amount of current flow to an electric motor **31**. Specifically, the webbing **16** is wound by rotation of a belt reel **15**, the rotation being controlled by current feedback so that the value of drive current of the electric motor **31** is equal to the value of current that allows a predetermined tension to be applied to the webbing **16**.

[0017] The seat belt device **10** has a configuration of three-point support system in which the webbing **16** is supported by three anchors: an upper anchor **13**, a center anchor **11**, and a lower anchor **18**. The upper anchor **13** is provided in an upper portion of a side of the vehicle body. The center anchor **11** is provided in a lower portion of the side of a seat **19**, that is opposite to the upper anchor **13**. The lower anchor **18** is provided below the upper anchor **13** of the seat **19**.

[0018] The webbing **16** includes a shoulder belt **16b** that restrains a shoulder of an occupant and a lap belt **16c** that restrains the waist of the occupant. There is mounted a tongue **23** between the shoulder belt **16b** and the lap belt **16c** (a folded portion of the webbing **16**). The tongue **23** is removably attached to a buckle **24** by one-touch operation, the buckle **24** being fixed to the center anchor **11**.

[0019] A buckle switch **27** is built in the buckle **24**. The buckle switch **27** outputs an ON signal when the tongue **23** is attached to the buckle **24** and outputs an OFF signal when the tongue **23** is removed from the buckle **24**.

[0020] Next, the control system of the seat belt device **10** according to the present embodiment will be described with reference to FIG. 2. Here, the pretensioner unit **50R** of the right side seat will be described as an example. Because the